Tool 15
Modeling Resources

This tool contains a review of two different types of modeling resources: watershed models that local governments should be aware of in order to access the data or utilize results from the models, and watershed models that are available to local governments to use in modeling different watershed scenarios

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Watershed Models with Useful Data

Important watershed models to know about include the Chesapeake Bay Program Watershed Model and the Scenario Builder, which are described below.

Chesapeake Bay Program Watershed Model

The Chesapeake Bay Program has developed a Watershed Model to estimate existing conditions and processes in the Chesapeake Bay and its contributing watershed areas. The most recent version of the Watershed Model, Phase 4.3 divides the 64,000 square mile Chesapeake Bay watershed into 94 segments for model analysis. The Watershed Model is a linked application of five models: an airshed model, watershed model, estuarine hydrodynamic model, estuarine water quality model, and a living resources model. The airshed model predicts atmospheric nutrient deposition to the Chesapeake Bay and its contributing watersheds, the results of which are input into the watershed model and estuarine water quality model. The watershed model uses the Hydrologic Simulation Program-Fortran (HSPF) and estimates the flow, nutrient and sediment loads into the Bay, the results of which are input into the estuarine water quality model. The hydrodynamic and water quality estuarine models predict water movement in the Bay and the fate of nutrients and sediments once they enter the Bay. The Living Resources Model, is under development, and will eventually simulate the influence nutrient and sediment loads entering the Bay have on aquatic animals and plants, including the consideration of complex food-chain and predator-prey relationships. The Watershed Model is currently managed by the CBP and model Phase 5.0 is under development by the CBP Model Subcommittee. Phase 4.3 model results for various land use management scenarios and regions are available from the CBP website, at http://www.chesapeakebay.net/restrtn.htm. When complete, the Phase 5.0 Watershed Model will divide the basin into 500 model segments, enabling finer scale applications, including possible use for State TMDL development.

Chesapeake Bay Program Scenario Builder

The scenario builder enables Tributary Teams to assess various agricultural, urban and Chesapeake Bay BMP implementation scenarios necessary to achieve tributary basin cap load allocations. The model estimates annual implementation costs, and can be used as a predictor for results of the more complex Chesapeake Bay Model. Model and supporting documentation, along with a Maryland specific Scenario Builder version, are available at:
http://www.chesapeakebay.net/info/wqcriteriatech/tributary_tools.cfm#ScenarioBuilder

Available Watershed Models

This section includes a list of watershed models that can assist watershed planners in a watershed (or subwatershed) treatment analysis by estimating water quality and quantity parameters for various land management scenarios. Two types of models are included in the review: spreadsheet loading models (Watershed Treatment Model and Simple Method) and simulation models. Generally speaking, the spreadsheet models have less input data and require less effort and cost to perform than simulation models. Both types of models return information that can be useful to evaluate watershed restoration goals and develop TMDLs.

The models listed in this section are those deemed most useful to watershed planning in Maryland and generally meet the following criteria:

- Apply at the watershed scale
- Estimate either water quality and/or quantity
- Are easy to obtain and apply
- Are commonly used in the watershed planning process

This listing is not intended to be comprehensive. For a more comprehensive summary of available simulation models for watershed loading, receiving waters, and ecological functions, the *Compendium of Tools for Watershed Assessment and TMDL Development* (Shoemaker, *et al.*, 1997) is an excellent resource document. Figure 1 is an overview of all the models reviewed in Shoemaker, *et al.* (1997), many of which are included in this review. The figure shows how models have been separated into three categories, simple, mid-range, and detailed, based upon model complexity. Table 1 provides a summary of modeling resources for watershed planning in Maryland, including description and web link and are presented in order from simple models to more complex models.

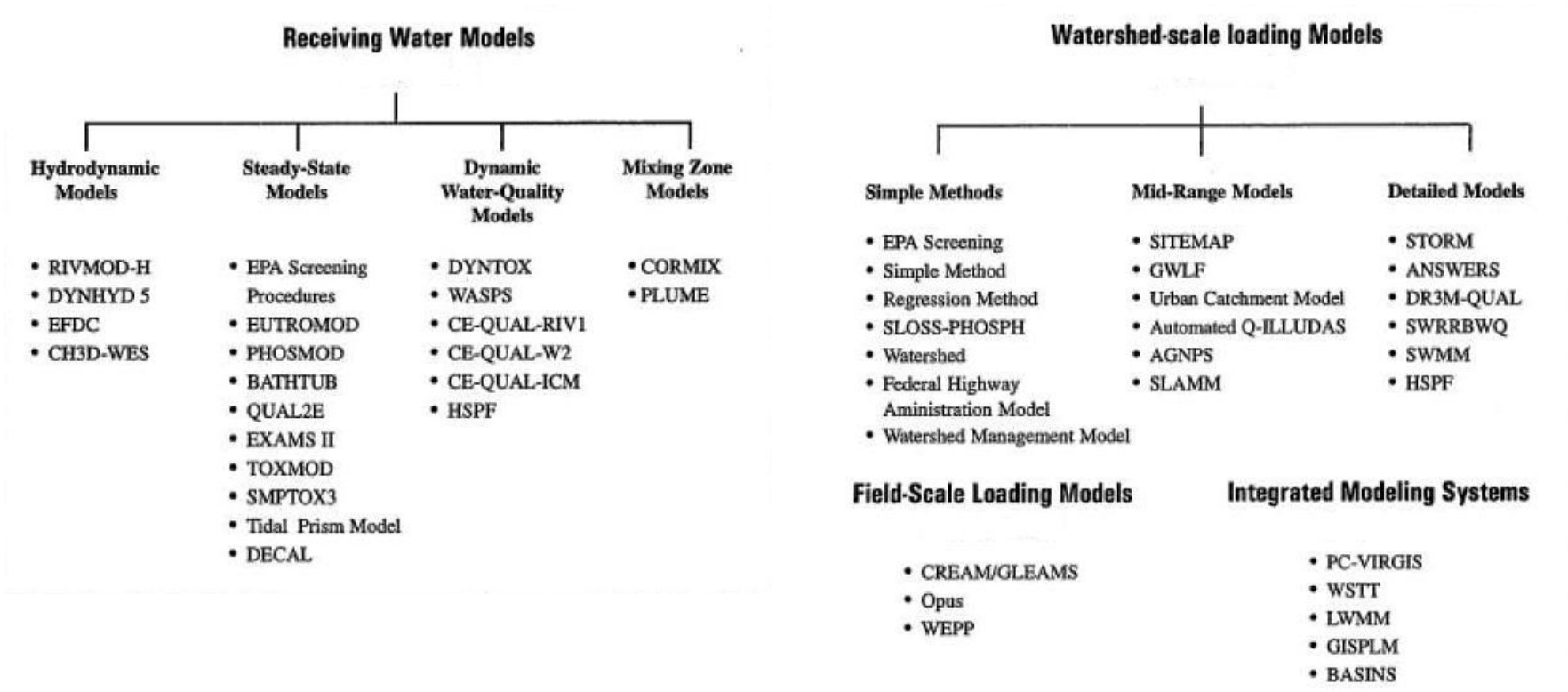

Figure 1: Overview of watershed loading and receiving water models described in the Compendium of Tools for Watershed Assessment and TMDL Development (Shoemaker et al., 1997)

Table 1: Modeling Resources for Watershed Planning in Maryland			
Source	*Name of Resource*	*Description*	*Website*
Metropolitan Washington Council of Government (MW-COG)	Simple Method	A spreadsheet model appropriate for small watersheds (<640 acres) that is used to estimate stormwater pollutant loads. Appropriate for evaluating pollutant loads based on various land use and impervious cover scenarios.	Model and support documentation free to download at: http://www.stormwatercenter.net/
Center for Watershed Protection	Watershed Treatment Model (WTM)	A simple tool for the rapid assessment and quantification of various watershed treatment options. WTM allows watershed managers to evaluate multiple treatment options based upon pollutant sources in urban and developing areas.	Model and support documentation free to download at: http://www.stormwatercenter.net/monitoring%20and%20assessment/watershed_treatment_model.htm
U.S. Army Corps of Engineers Hydraulic Engineering Center (HEC)	HEC-RAS, River Assessment System and HEC-HMS, Hydrologic Modeling System	Storm event surface runoff and hydraulic calculations based upon watershed land use and channel characteristics, designed for flood management assessments and channel design. Not capable of water quality calculations.	Model and support documentation free to download at: http://www.hec.usace.army.mil/
Cornell University	GWLF, Generalized Watershed Loading Functions	Estimates stream flow, sediment and nutrient (phosphorus and nitrogen) loads from urban and agricultural land uses. The model can also be used to evaluate basin-wide management strategies.	Distributed by the Cornell University Department of Agriculture and Biological Engineering: Ithaca, NY 14853 - (607) 255-2802
William W. Walker Jr.	P8, Program for Predicting Polluting Particle Passage through Pits, Puddles, and Ponds	Continuous or single event simulation of hydrology and water quality, that relies on NRCS curve number methods. Good capability to deal with structural stormwater treatment, but not designed to assess soluble pollutants.	Model and support documentation free to download at: http://wwwalker.net/p8/
United States Department of Agriculture	AGNPS, Agricultural Non-Point Source Pollution Model	Quantitatively estimates point and non-point source pollution from agricultural watersheds for various land use and land conservation scenarios.	Model and support documentation free to download at: http://www.ars.usda.gov/Research/docs.htm?docid=5199

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University of Maryland	GIShydro2000	GIShydro2000 is a GIS-based software program for performing hydrologic analysis. It consists of a database of hydrologic layers and an ArcView™ application with customized modeling tools. Some Features Include: • Complete database of DEM, land use, and soils data for Maryland drainage area. • Watershed and channel delineation. • Watershed statistics (drainage area, RCN, tc, more). • Peak discharge estimates from USGS regional regression equations (with confidence intervals). • Interface to TR-20 for subdivision, parameter calculation, rating tables, and channel routing.	For more info: http://www.gishydro.umd.edu/
PV & Associates	SLAMM, Source Loading and Management Model	Uses small storm hydrology to evaluate non-point source pollution from urban areas. Has the ability to evaluate a range of source areas and control alternatives to estimate outfall discharges, emphasizing particulate and dissolved pollutant concentrations.	For purchasing information, see: http://winslamm.com/
NOAA Coastal Services Center	N-SPECT, Non-Point Source Pollution and Erosion Comparison Tool	GIS based model that allows coastal watershed managers to predict the impact of land use conversions on stream and river water quality. The model specifically evaluates changes in surface water runoff, non-point source pollution, and erosion.	Model and support documentation free to download at: http://www.csc.noaa.gov/crs/cwq/nspect.html
U.S. Environmental Protection Agency	SWMM, Stormwater Management Model, Version 5	An urban rainfall-runoff model capable of estimating runoff quality and quantity on a watershed scale. Commonly used to design sewer and stormwater facilities and evaluate BMP effectiveness. Requires training and experience to achieve proficiency.	Model and support documentation free to download at: http://www.epa.gov/ednnrmrl/swmm/
United States Geological Survey	HSPF, Hydrologic Simulation Program – Fortran	Continuous simulation of watershed hydrology, with an emphasis on watershed land use. HSPF can be used for TMDL development and to estimate water quantity and quality in response to watershed planning alternatives. Requires training and experience to achieve proficiency.	Model and support documentation free to download at: http://water.usgs.gov/software/hspf.html

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United States Geological Survey	DR3M-QUAL: Multi-Event Urban Runoff Quality Model	Continuous or single event simulation of surface runoff and water quality designed for the subwatershed scale.	Model and support documentation free to download at: http://water.usgs.gov/software/surface_water.html
Systech Engineering, Inc.	WARMF, Watershed Analysis Risk Management Framework	GIS based model that estimates multiple water quality parameters to support TMDL calculations and includes a stakeholder decision-making support system.	For more info: http://www.systechengineering.com/warmf.htm

References cited: Shoemaker, L., M. Lahlou, M. Bryer, D. Kumar, K. Kratt. May 1997. Compendium of Tools for Watershed Assessment and TMDL Development. United States Environmental Protection Agency, Washington, D.C.